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Geology of Bayly Township District of Timiskaming

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MINISTRY OF NORTHERN DEVELOPME
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by
H.L. Lovell and F.R. Ploeger

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GEOLOGICAL MAP
(back pocket)

Map P.1198 (Revised), (uncoloured) - Geological Series, Bayly Township, District of Timiskaming, scale 1:15 840 or 1 inch to ¼ mile.

Conversion Factors for Measurements in Ontario Geological Survey Publications

If the reader wishes to convert imperial units to SI (metric) units or SI units to imperial units the following multipliers should be used:

CONVERSION FROM SI TO IMPERIAL			CONVERSION FROM IMPERIAL TO SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0 039 37	inches	1 inch	**25.4**	mm
1 cm	0 393 70	inches	1 inch	**2.54**	cm
1 m	3 280 84	feet	1 foot	**0.304 8**	m
1 m	0 049 709 7	chains	1 chain	20 116 8	m
1 km	0 621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0 155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10 763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0 386 10	square miles	1 square mile	2 589 988	km^2
1 ha	2 471 054	acres	1 acre	0 404 685 6	ha
			VOLUME		
1 cm^3	0 061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35 314 7	cubic feet	1 cubic foot	0 028 316 85	m^3
1 m^3	1 308 0	cubic yards	1 cubic yard	0 764 555	m^3
			CAPACITY		
1 L	1 759 755	pints	1 pint	0 568 261	L
1 L	0 879 877	quarts	1 quart	1 136 522	L
1 L	0 219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0 035 273 96	ounces (avdp)	1 ounce (avdp)	28 349 523	g
1 g	0 032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2 204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0 001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1 102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0 000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0 984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
			CONCENTRATION		
1 g/t	0 029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0 583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy)/ton (short)	20.0	pennyweights/ton (short)
1 pennyweight/ton (short)	0 05	ounce (troy)/ton (short)

NOTE—Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries published by The Mining Association of Canada in cooperation with the Coal Association of Canada.

ABSTRACT

Bayly Township is located about 11 km east-northeast of the Town of Englehart and is 24 km directly south of the community of Larder Lake in the District of Timiskaming.

About one-third of the map-area is underlain by Early Precambrian intrusive and metavolcanic rocks and forms the upper half of the "Skead volcano" and the intercalated base of an overlying cycle of volcanism. These rocks include: intermediate and felsic breccias, tuffs, and rare flows; cherty tuff; mafic breccia and flows; and intermediate to felsic, mafic, and ultramafic intrusive rocks.

The remaining two-thirds of the township are underlain by Middle Precambrian (Huronian) metasediments intruded by sills and dikes of Nipissing Diabase. The metasediments comprise mudstone, conglomerate, arkose, feldspathic greywacke, and argillite.

All rock types, including the metavolcanic and intrusive rocks, are cut by a Late Precambrian diabase dike. Pleistocene and Recent deposits of sand, gravel, boulders, silt, clay, and peat cover parts of the map-area.

Mineral exploration in the past was directed towards prospecting for silver and gold after the discoveries made of these precious metals in the Cobalt area and the Larder Lake-Swastika area. More recently, attention has been given to the exploration for base metals in Bayly Township.

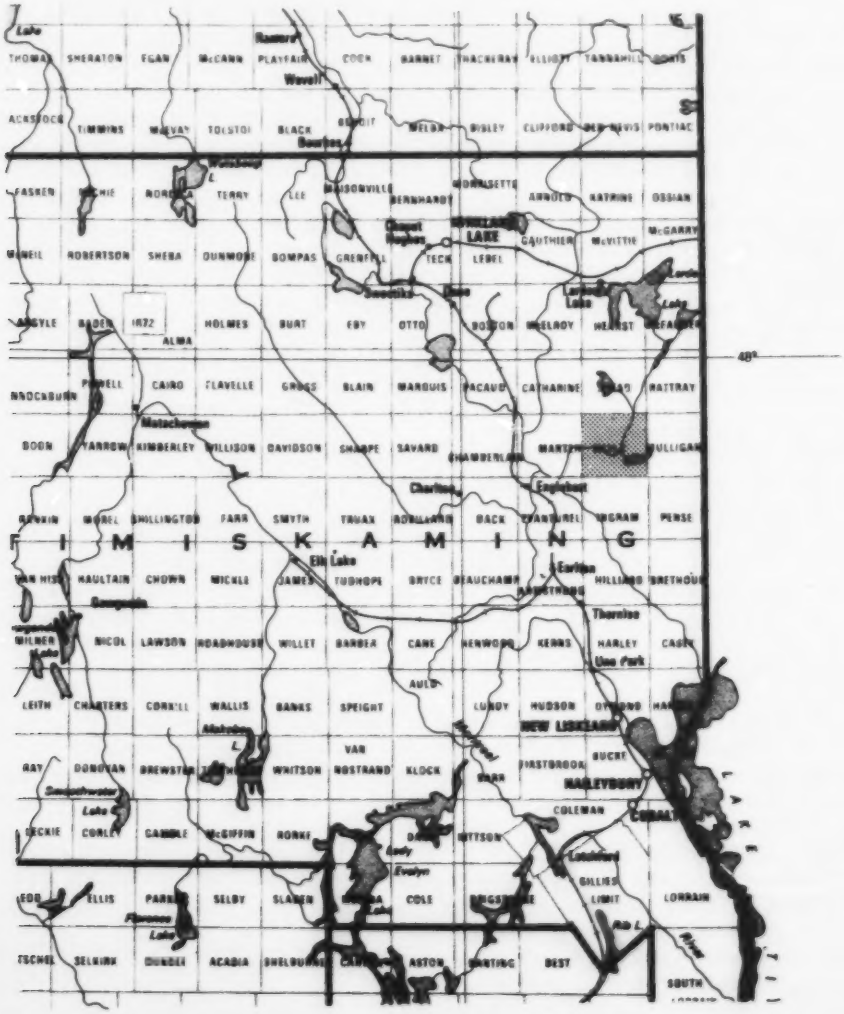

Figure 1 - Location map for Bayly Township. The scale is 1:1 013 760 (1 inch to 16 miles).

GEOLOGY OF BAYLY TOWNSHIP DISTRICT OF TIMISKAMING

BY
H. L. LOVELL[1] AND F. R. PLOEGER[2]

INTRODUCTION

Bayly Township is a 69.7 km square township located about 11 km east-northeast of the town of Englehart and 24 km directly south of Larder Lake in the District of Timiskaming. It is bounded by Latitudes 47°50'30"N and 47°55'39"N, and Longitudes 79°38'00"W and 79°45'00". Wendigo Lake, the main lake for cottagers in the Englehart area, is in the centre of the township.

The first prospecting began in the diabase to search for silver after the discovery of the precious metal around Cobalt in 1903 (Burrows and Hopkins 1922). In 1906-07, gold was discovered near Larder Lake. This initiated another rush (Hewitt 1949) in which prospectors migrated southwards searching out shears and quartz veins in the Early Precambrian (Archean) intrusive and volcanic rocks. Sporadic prospecting for gold and silver continued throughout the 1920s and 30s. In the late 1960s attempts were made to locate base-metal mineralization within the sequence of felsic tuffs and breccias.

Access

Access to most of the central parts of the map-area is gained by way of Wendigo and Skeleton Lakes which horizontally bisect Bayly Township. A north-trending (upper) arm of Wendigo Lake provides access to the north-central and eastern parts of the map-area. The lake itself may be reached by gravel cottage roads and Ministry of Natural Resources access roads that extend north from Highway 569. Northern and northwestern parts of the map-area are made accessible by concession and logging roads extending east from Highway 624.

Present Geological Survey

Geological mapping was completed during the summers of 1974 and 1975 from the Kirkland Lake Resident Geologist's Office for the Ontario Geological Survey. Mapping was carried out at a scale of 1:15 840 (1 inch to ¼ mile). Geological information derived from pace-and-compass traverses was plotted on acetate sheets over aerial photographs. This information was then transferred to cronaflex base maps compiled from Forest Resources Inventory sheets of the Division of Forests, Ontario Ministry of Natural Resources. Traverses were made directly to all outcrops observed on aerial photographs and at intervals of 0.4 km where outcrops were not observable. Representative hand specimens were taken of the different rock types encountered and a total of 38 thin sections were cut and examined.

Acknowledgments

Assistance in the field in 1975 was provided by Carl Forbes and Gary Grabowski. Jan deGrijs, the former Kirkland Lake Resident Geologist's Assistant, mapped part of Bayly Township during the summer of 1974. Thanks are also extended to L. S. Jensen (Geologist, Ontario Geological Survey) for providing the whole rock analyses.

Previous Geological Work

Many of the geographical features of the area were known as early as 1632 by French fur traders. In their report, A. G. Burrows and P. E. Hopkins (1922) summarize work done in Bayly Township and the surrounding area prior to 1921. This included: a micrometer survey made by W. McOuat (1872) along the Blanche River from Lake Timiskaming to Round Lake; geological mapping in the Wendigo Lake area by W. G. Miller (1902); the examination of geology along the major canoe routes in the area by W. A. Parks (1904); and, R. E. Hore's (1913) mapping of parts of Bayly, Mulligan, Ingram, and Pense Townships.

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[2]Resource Geologist, Ontario Ministry of Natural Resources, Kirkland Lake. Manuscript approved for publication by the Chief Geologist, 9th August, 1979. This report is published with the permission of E. G. Pye, Director, Ontario Geological Survey.

The complete geology of Bayly Township was first outlined by Burrows and Hopkins (1922) in their report of the Blanche River area. Their rock subdivisions and geological contacts closely coincide with those of the writers'. Skead Township, which adjoins Bayly Township to the north, and Catherine and Marter Townships to the northwest and west, were mapped by D. F. Hewitt (1949) and J. A. Grant (1964) and Ridler (1969); Ridler *et al.* (1975) expanded on this previous work and concluded that the volcanic sequence in Catherine, Marter, and Skead Townships constituted a volcanic cycle (Skead Group) consisting of a basaltic base (Catherine basalts) and a felsic top (Skead pyroclastics). Ridler determined that intrusive and extrusive felsic porphyries on the east side of St. Anthony Lake made up the volcanic centre. H. L. Lovell (1977) completed mapping of the Englehart-Earlton area adjoining Bayly Township to the south.

In addition to the geological reports mentioned above, Ontario Geological Survey compilation maps 1934a (Hurst 1943), P. 159 (W. S. Savage *et al.* 1962), Map 2046 (R. M. Gunn *et al.* 1964), and Map 2205 (D. R. Pyke *et al.* 1973) also cover this area.

Topography and Drainage

Wendigo Lake is part of the Larder River chain of interconnecting lakes and rivers which forms the major drainage system in the area. Several small intermittent streams flow southeasterly into the main body and west arm of the lake. Skeleton Lake, which flows through Skeletonpup Lake, has its outlet into the north arm of Wendigo Lake.

The water of Wendigo Lake is at an elevation of approximately 230 m above sea level. Steep scarps rise about 75 m above the lake from both sides of the shores of it as well as the north-trending arm. Erosion-resistant sedimentary rocks form the escarpments along the shores of the main body and the east shore of the northern arm of Wendigo Lake. However, on parts of the north shore of the main body of Wendigo Lake and on most of the west shore of the north arm of Wendigo Lake, mafic intrusive rocks and felsic pyroclastic rocks form the steep high slopes. The gently rolling area underlain by intermediate pyroclastic rocks in the northwest part of Bayly Township is at an elevation of about 300 m above sea level. A deep valley has formed 1.5 km west of the north arm of the lake along the contact between intermediate pyroclastic rocks and a mafic intrusive mass.

The area to the south of Crystal Lake consists of several hummocky outcrops of Nipissing Diabase that rise more than 75 m above the surrounding clay belt. Clay and sand predominate in an area of low relief north of Skeleton Lake.

Natural Resources

There have been few attempts at farming in Bayly Township because of the high density of outcrop although the southern part of the area, 1st concession has some developed farmland. Timber is currently being cut. Timber was the main basic resource in the past. In the northwestern one-third of the township, several old lumber camps, saw mills, and timbered areas were encountered while on traverses, thus indicating that timber was a major resource of the area in the past. At the time of mapping, spruce, jack pine, birch and poplar were being harvested along parts of the western boundary of the township, north and south of Wendigo Lake and west of Mallard Lake. Birch and poplar are the dominant tree types, but large white spruce, jack pine, red and white pine, and cedar were observed, particularly in areas of outcrop and eskers.

Several gravel pits within the map-area were in use for the maintenance of access roads and for nearby cottage development.

Wildlife is abundant in the area. Moose, beaver, rabbit, and partridge were seen and signs of bear and deer were plentiful. The presence of traplines indicated that beaver, mink, and other valuable fur-bearers were being harvested. Smallmouth bass, pickerel, and lake trout provide excellent sport fishing for cottage owners and tourists on Wendigo Lake, and the surrounding lakes in Bayly Township.

GENERAL GEOLOGY

The age of the bedrock in the map-area ranges from Early to Late Precambrian. The basement rocks consist mainly of Early Precambrian metavolcanics, intermediate to felsic breccia and tuff, massive mafic flows, intermediate and mafic intrusive rocks. Nipissing Diabase and Huronian argillite, conglomerate, and arkose constitute the Middle Precambrian age rocks. A northeast-trending, Late Precambrian diabase dike cuts across all the rock types mentioned above. Table 1 summarizes the lithological units in Bayly Township.

The volcanic rocks underlie about 35 percent of Bayly Township; the rest is underlain by Cobalt Group sedimentary rocks and Nipissing Diabase. Intermediate to felsic breccia and tuff form part of a thick volcanic pile (Hewitt 1949; Grant 1964; Ridler 1969), the base of which extends for more than 30 miles around the eastern end of the Round Lake Batholith.

TABLE 1 | TABLE OF LITHOLOGIC UNITS FOR BAYLY TOWNSHIP

PHANEROZOIC
CENOZOIC
QUATERNARY
RECENT
Swamp, lake, and stream deposits
PLEISTOCENE
Till, esker, and glaciolacustrine deposits
Unconformity
PRECAMBRIAN
LATE PRECAMBRIAN
MAFIC INTRUSIVE ROCKS
Augite diabase, granophyric-texture diabase, varied-texture diabase
Intrusive Contact
MIDDLE PRECAMBRIAN
MAFIC INTRUSIVE ROCKS
NIPISSING DIABASE
Diabase, quartz diabase, hypersthene diabase
Intrusive Contact
HURONIAN SUPERGROUP
COBALT GROUP
GOWGANDA FORMATION
COLEMAN MEMBER
Pebbly mudstone, conglomerate, arkose, feldspathic greywacke, argillite, laminated argillite with dropstones
Unconformity
EARLY PRECAMBRIAN
MAFIC TO ULTRAMAFIC INTRUSIVE ROCKS[1] (EARLY ALGOMAN OR KEEWATIN)[2]
Serpentinized gabbro and pyroxenite; gabbro, diorite
Intrusive Contact
INTERMEDIATE TO FELSIC INTRUSIVE ROCKS (KEEWATIN)
Feldspar porphyry
Intrusive Contact
METAVOLCANICS (KEEWATIN)
FELSIC METAVOLCANICS
Cherty tuff, breccia
INTERMEDIATE METAVOLCANICS
Andesite-dacite, dacite, breccia, tuff
MAFIC METAVOLCANICS
Basalt, andesite-basalt, breccia

[1]May partly be massive flows
[2]Terms in brackets are included to assist correlation of units with descriptions previously published

Cobalt Group sedimentary rocks fill a north-south trending depression of probable fault origin east of the north-trending arm of Wendigo Lake, and a basin possibly related to rifting to the south of the lake. Several sills of Nipissing Diabase have intruded the Cobalt Group sedimentary rocks generally along flat-lying, laminated argillite units south of Wendigo Lake and Skeleton Lake.

PRECAMBRIAN

EARLY PRECAMBRIAN (ARCHEAN)

METAVOLCANICS

The predominant metavolcanics of Bayly Township constitute part of the felsic unit of the Catharine-Skead volcanic pile or Skead Group (Ridler *et al.* 1975). The "Skead volcano" (Ridler 1969) has the form of a large, open, symmetrical, almost vertically plunging anticline that envelopes the eastern end of the Round Lake Batholith. Eastward from the batholith for a distance of 17.3 km, that is up the stratigraphic section, the strata dip steeply east. The base of the pile is composed of approximately 8.5 km of dominantly tholeiitic pillow lavas and associated massive phases (Ridler 1969) which lie to the west of the map-area. Conformably overlying the basalts and comprising the predominant unit in Bayly Township, is a 8.8 km thick pile of intermediate to felsic breccia and tuff, the upper parts of which contain intercalated mafic and ultramafic flows and sills. The volcanic centre of the pile, which intersects the present erosional surface on the east shore of St. Anthony Lake, is represented by "a large plug of quartz porphyry" (Hewitt 1949) which plunges southwest from its position below the apex of the "Skead volcano". The locations and results of chemical analyses (Tables 2 and 3) from Ridler's work (1969) and of samples taken by the writer (analysed by the Geoscience Laboratories , Ontario Geological Survey) are plotted on Figures 2 and 3.

Mafic Metavolcanics

The suite of mafic metavolcanics in Bayly Township comprises fine- to coarse-grained basalt, andesite-basalt, mafic breccia, and flow-top breccia of tholeiitic composition. Some gabbros and diorites classified with the mafic to ultramafic intrusive rocks may in fact represent

TABLE 2: Chemical Analyses from north half of Skead Group (from Ridler 1969)

Sample Number	67	68	69	70	71	72	75	76	77	78	79	80
	Major Components in Weight Percent											
SiO_2	54.5	46.4	56.0	46.5	48.4	48.1	55.9	48.9	61.9	61.6	46.9	47.2
Al_2O_3	13.7	11.6	12.6	11.6	12.4	13.1	16.5	13.0	15.3	15.0	10.2	11.7
Fe_2O_3	6.4*	8.4*	0.8	16.9*	12.9*	11.3	5.7*	12.2	5.3*	5.4*	4.9	15.0*
FeO			5.5			6.6		4.6			10.2	
MgO	4.4	7.3	6.4	3.4	8.8	5.8	3.5	5.0	4.5	5.1	4.8	7.9
CaO	6.3	7.5	5.8	11.5	12.5	8.9	5.0	8.8	4.2	4.3	14.2	11.1
Na_2O	4.0	3.0	4.5	2.5	2.5	2.6	1.0	2.1	4.5	4.5	2.6	2.2
K_2O	2.8	0.8	0.5	0.4	0.2	0.1	5.2	0.1	1.5	1.5	0.1	0.1
TiO^2	0.56	0.54	0.59	1.23	0.80	1.31	0.45	1.29	0.40	0.39	1.16	0.99
P_2O_5			0.17			0.10		0.09			0.08	
MnO	0.37	0.14	0.16	0.34	0.20	0.25	1.24	0.25	0.11	0.10	0.29	0.21
H_2O+	6.5+	12.0+	5.2+	5.0+	3.0+	4.6+	5.5+	4.2+	2.5+	2.5+	5.3+	3.5+
Total	99.53	97.68	98.22	99.37	101.70	102.76	99.99	100.53	100.21	100.39	100.73	99.90

*Total iron reported as Fe_2O_3

+Total (CO_2 + H_2O^+)

Sample No.	Sample Descriptions and Locations
67	Skead pyroclastic unit - breccia and crystal tuff from Cathroy Larder mine
68	Skead pyroclastic unit - unit breccia and tuff from Hwy 564
69	Skead pyroclastic unit - crystal tuff and breccia from Hwy 564
70	Catherine basalt unit - pillow lava from Hwy 564
71	Catherine basalt unit - massive flow from Hwy 564
72	Catherine basalt unit - massive flow from Hwy 564
75	Skead pyroclastic unit - breccia and tuff from Cathroy Larder mine
76	Catherine basalt unit - massive flow from Hwy 564
77	Skead pyroclastic unit - massive flow from north of Hwy 564
78	Skead pyroclastic unit - massive flow from north of Hwy 564
79	Catherine basalt unit - pillow lava from Hwy 564
80	Pacaud tuff unit - banded tuff from Hwy 564

massive extrusive flows. All mafic metavolcanics, with the exception of the mafic breccias, outcrop on the ridge west the northern arm of Wendigo Lake. These mafic metavolcanics overlie the felsic and intermediate metavolcanics and represent the commencement of a later cycle of effusive volcanism. Ridler (1969) stated that these mafic flows form the base of the McVittie basaltic sequence and that the interflow felsic tuff and breccia are suggestive of the waning stages of Skead felsic volcanism. No mafic pillowed flows were found in these rocks during the current mapping, although they are present in the underlying Catherine basalts (Grant 1964; Ridler 1969) and the overlying mafic metavolcanics (Hewitt 1949; Ridler 1969).

Outcrops of fine-grained mafic metavolcanics weather to a dark to medium green. Weathered surfaces of medium- to coarse-grained mafic metavolcanics are generally "salt-and-pepper" textured; ferro-magnesian minerals weather to a rusty or dark green and the feldspar grains to a buff. Fresh surfaces of fine- and medium-grained high iron tholeiite are medium to dark greenish black, whereas high-magnesium tholeiite units appear pale to medium green or grey green.

In thin section, the feldspar is almost entirely altered to sericite and chlorite. Some original pyroxene remains, but most is altered to tremolite-actinolite, epidote, and chlorite. In addition, small amounts of quartz, carbonate,

TABLE 3: Chemical Analyses from Bayly Township. Chemical Analyses by Geoscience Laboratories, Ontario Geological Survey

Sample Number	4	12	15	20	22		40	41	42	45	47	56
						Major Components in Weight Percent						
SiO_2	60.3	48.8	60.8	63.2	48.4	53.6	46.1	61.9	49.4	56.5	42.2	63.9
Al_2O_3	15.8	16.2	15.7	17.8	16.9	22.9	12.6	16.3	14.6	14.2	7.63	15.1
Fe_2O_3	6.78*	9.71*	5.71*	4.12*	11.8*	5.46*	11.7*	5.37*	12.9*	6.97*	13.6*	4.69*
MgO	3.8	7.68	4.15	3.40	7.64	4.55	14.4	2.90	7.85	8.48	23.5	3.90
CaO	5.47	11.3	5.25	2.16	8.20	4.56	7.82	4.89	9.51	5.68	6.19	2.27
Na_2O	3.51	2.42	3.91	5.14	2.41	3.02	1.33	4.89	1.90	2.64	0.03	3.90
K_2O	0.95	1.02	0.80	1.34	0.22	1.42	1.05	1.03	0.26	0.57	0.06	1.56
TiO_2	0.62	0.71	0.54	0.45	1.01	0.51	0.64	0.54	1.06	0.58	0.42	0.74
P_2O_5	0.21	0.10	0.16	0.13	0.13	0.14	0.09	0.21	0.14	0.18	0.08	0.24
MnO	0.11	0.18	0.12	0.07	0.18	0.08	0.18	0.10	0.19	0.10	0.20	0.11
H_2O+	2.50+	1.99+	3.31+	2.39+	3.19+	3.35+	4.07+	1.67+	2.23+	4.51+	6.79+	3.43+
	100.0	100.1	100.4	100.2	100.1	99.6	100.0	99.8	100.0	100.4	100.7	99.8

* Total iron reported as Fe_2O_3

\+ Total (CO_2 + H_2O+)

Sample Number	Field Description	Composition
4	andesite/dacite tuff (crystal)-possibly a flow?	calc-alkaline andesite
12	diorite - intrusive	high magnesium tholeiitic basalt
15	dacite/andesite breccia	calc-alkaline andesite
20	dacite tuff (possibly a flow)	calc-alkaline dacite
22	andesite flow	high magnesium tholeiitic basalt
25	dacite/andesite crystal tuff	calc-alkaline dacite
40	altered gabbro (massive part of flow)	basaltic komatiite
41	feldspar porphyry feeder dike	calc-alkaline dacite/andesite
42	andesite-basalt flow	high magnesium tholeiitic basalt
45	andesite/dacite breccia	high magnesium tholeiitic basalt
47	altered (serpentinized) mafic to ultramafic flow	basaltic/ultramafic komatiite
56	dacite crystal tuff	calc-alkaline andesite

serpentine, pyrite and magnetite are present in thin section. Original textures have been obscured by alteration. An outcrop of massive basalt located about 600 m south of the contact with the Late Precambrian diabase dike on the west shore of the north arm of Wendigo Lake comprises at least two massive flows. The maximum thickness of an individual flow is estimated at approximately 120 m.

Intermediate Metavolcanics

The intermediate metavolcanics of Bayly Township include andesite-dacite and dacite breccia, massive and bedded tuff, crystal tuff and rare massive flows.

Field mapping has shown that a 5000 m section of discontinuous outcrop between the Bayly-Marter Township boundary on the west and the Cobalt Group sediment-filled valley west of upper Wendigo Lake on the east, is composed almost exclusively of intermediate pyroclastic rocks of the Skead Group as described by Ridler (1969) and Ridler *et al.* (1975). Between the sediment-filled valley and the north-trending arm of Wendigo Lake, the intermediate metavolcanics are interbedded over a distance of about 1600 m with mafic intrusive rocks and massive flows. Within this area, a progression up the stratigraphic section exists from breccia and tuff into well-bedded cherty tuff and cherty breccia, the location of the largest development of the latter rocks in Bayly Township.

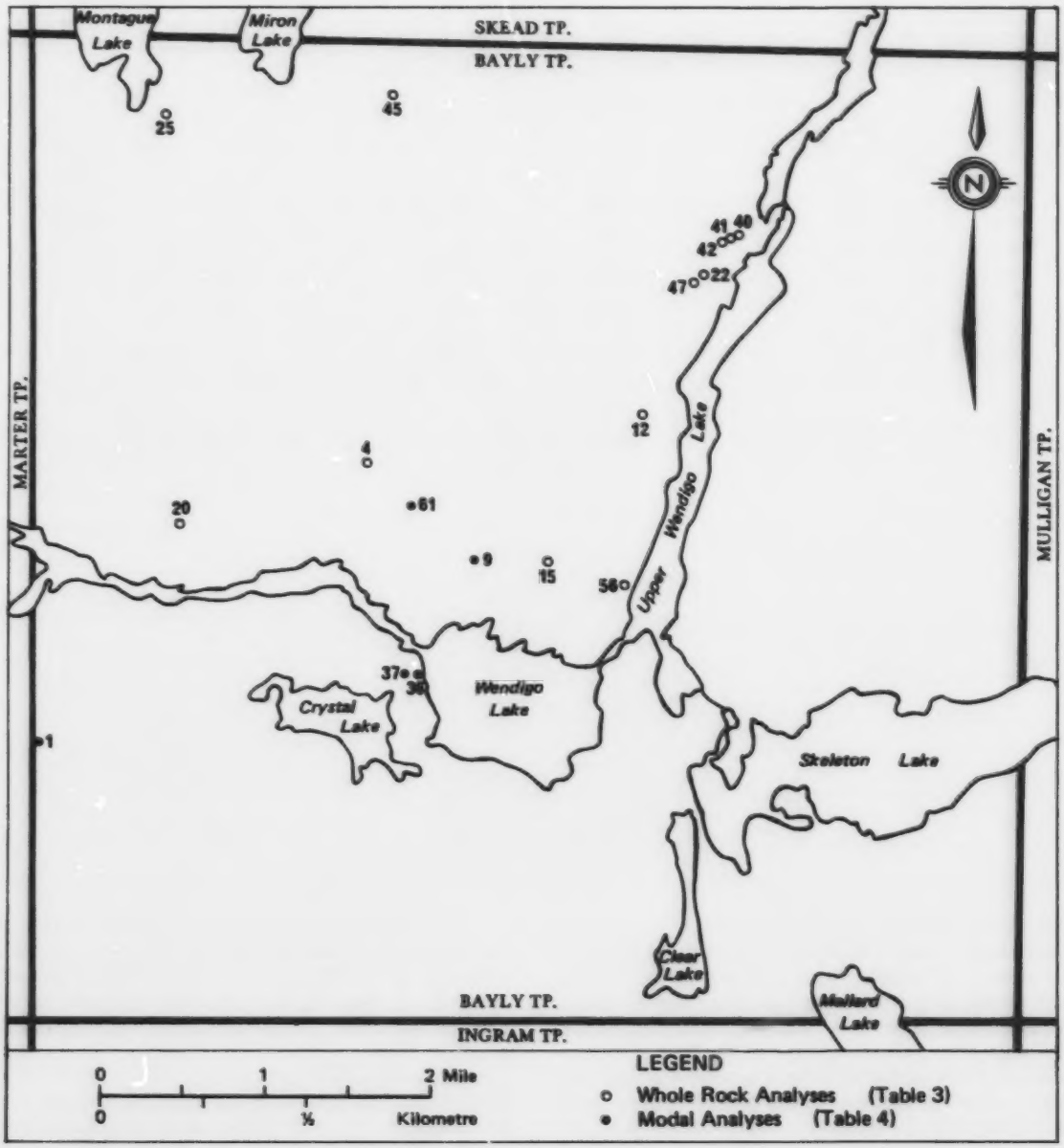


Figure 2 - Sketch map showing locations of samples analysed by the Geoscience Laboratories, Ontario Geological Survey, Toronto.

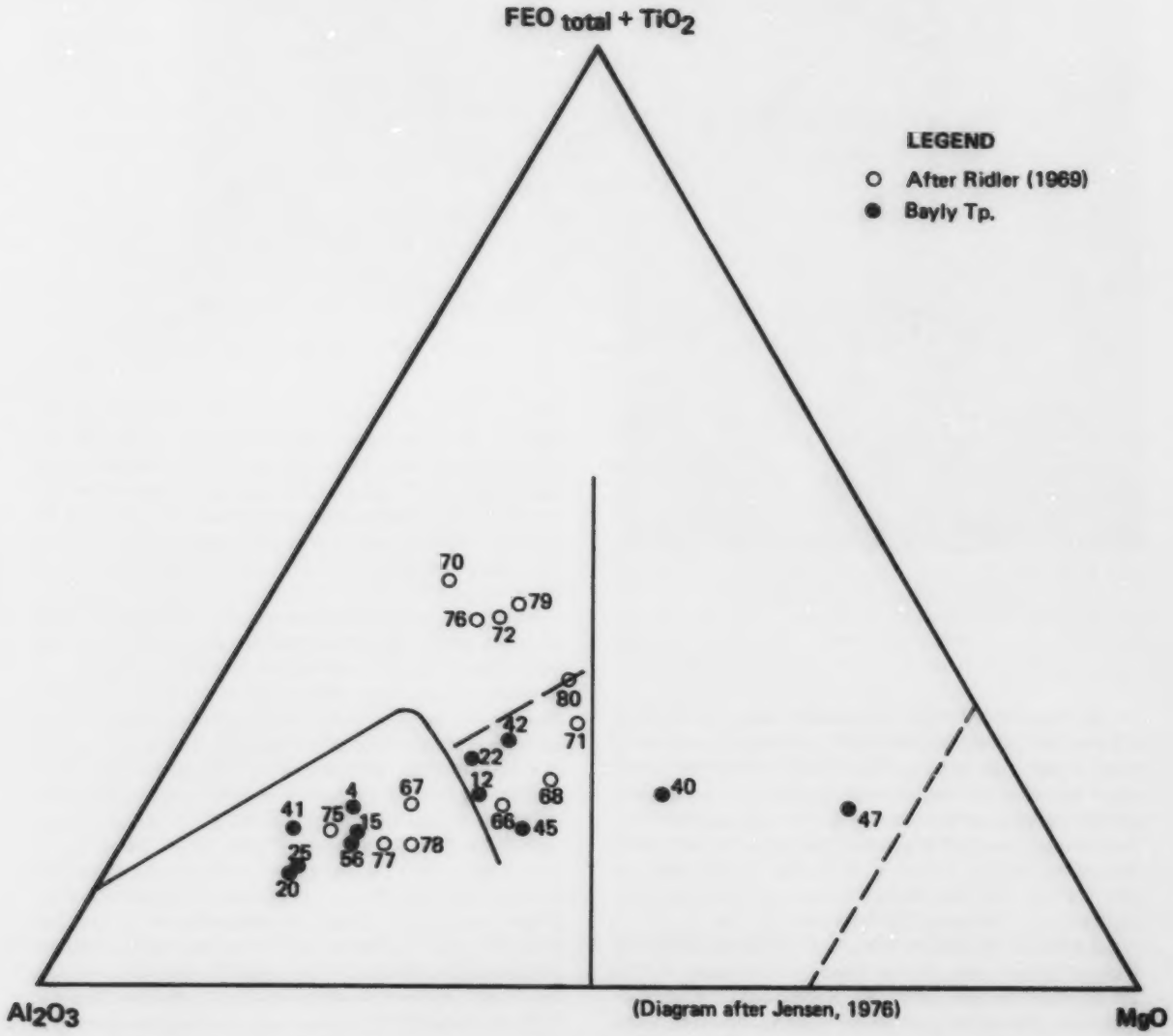


Figure 3 - Plot of chemical analyses showing variations in chemistry in Bayly Township and north half of Skead Group after Ridler (1969).

Photo 1 - Large intermediate breccia fragment that includes several smaller fragments.

In the area south of Miron and Montague Lakes, the breccia units include mafic and felsic fragments. Mafic fragments are less abundant and tend to weather more deeply than the felsic fragments. All fragments are angular to subangular and range in size from single broken microscopic feldspar grains to 35 cm blocks. On the southwest shore of the northern arm of Wendigo Lake and also inland, coarse crystal tuff and bedded tuff predominate. One outcrop on the west shore near an old adit contains a large (40 cm diameter) block that included several small (3 to 4 cm) mafic fragments (Photo 1).

The matrix of the fragmentals and interbedded massive and poorly bedded tuffs comprise: fine-grained, medium to dark green-coloured ash; coarse lithic tuff made up of small porphyritic clasts; and crystal tuff containing broken feldspar clasts. The tuffs weather to a dark to medium buff-green or a light green to buff-white depending on the andesitic or dacitic composition. In thin section, the fine matrix appears to be completely saussuritized. However, feldspar crystals, show only a slight amount of sericite alteration in many cases. The feldspar grains range in size from approximately 0.1 to 1.0 mm and are generally euhedral to subhedral, though many are fractured and broken. Determinations from preserved polysynthetic albite twins yield compositions in the andesine range (An_{35}).

Mafic breccia fragments, although they do not occur extensively, are more abundant in the western part of the map-area near the boundary with Marter Township than in the area immediately west of the northern arm of Wendigo Lake. Two types of mafic fragments predominate: dark green, fine-grained, massive angular fragments of possible basaltic composition; and medium-grained, foliated, commonly porphyritic fragments of dioritic appearance.

Intermediate to felsic fragments consist of three main varieties which generally weather to a buff-white and stand higher than the matrix on a weathered surface. On a fresh surface, these fragments are medium green-grey to light buff-green. Each of these types vary individually in form, composition, and lithologic origin, and include porphyritic flow material, lithic tuff, and crystal tuff. Fragments of flow material contain light pale-green euhedral feldspar phenocrysts, about 1.0 mm in length, and waxy, medium green coloured mafic clots, 0.5 mm in diameter, set in a fine-grained buff-white groundmass or in a light grey felty groundmass of feldspar crystals. Pitted fragments of possible pumiceous origin were observed in several outcrops. Lithic tuff and crystal tuff are similar in appearance to one another and differ only in the higher proportion of lithic clasts found in the lithic tuff. Both generally contain pale, buff-green subhedral feldspar grains up to 2.0 mm in length, which in thin section appear fractured and broken. The goundmass consists of fine divitrified glass shards, small lithic fragments, broken feldspar crystals, and small mafic clots composed of partly altered pyroxene grains. In thin sections of samples taken from the middle and upper sec-

tions of the pyroclastic pile in Bayly Township, the feldspar grains and matrix were observed to almost totally altered to sericite, chlorite, and epidote. A composition of andesine (about An_{33}) was determined from a limited number of extinction angle measurements of faint polysynthetic twins of plagioclase from the matrix and fragments. Glass shards appear as altered elongate globular and triangle-shaped fragments.

No quartz phenocrysts were seen on outcrops within the map-area, and only rare small grains (less than 0.1 mm) were identified in thin section. Mafic clots in the intermediate fragmentals consist predominantly of pyroxene, or where altered, chlorite and uralite.

Felsic Metavolcanics

The felsic metavolcanics in the map-area consist entirely of fine-grained bedded tuff, cherty tuff, and cherty breccia. Rhyolite flows and intrusive rocks such as those found in Skead Township by D. F. Hewitt (1949) were not observed to outcrop in Bayly Township. This is presumably because in Bayly Township these rocks occur higher in the stratigraphic section in an area overlain by Proterozoic rocks or because the area is more distant from the volcanic vent at St. Anthony Lake. The felsic tuff and breccia outcrops in the map-area only on the ridge along the west shore of the northern arm of Wendigo Lake. There, they are found interbedded with an overlying sequence of massive mafic and intermediate volcanic flows and mafic and ultramafic intrusive rocks. In outcrop, the finely bedded tuff ad cherty tuff appear as uniform beds that strike generally north and dip east from 50° to 75°. Graded beds indicate that tops face east. The weathered surface is generally white to buff; zones more rich in chert appear medium grey. One contact between a tuffaceous bed and more cherty bed, 60 m west and .90 m south of the point where the Late Precambrian diabase dike crosses the west shore of the northern arm of Wendigo Lake, is ripple-marked (Photo 2). Here, a large block measuring approximately 2 m square by 1.5 m thick has dropped from a small overhang, and the sinuous ripples in the top of a tuffaceous bed are exposed. The ripples measure about 6 cm from crest to crest. This may indicate a shallow submarine depositional environment for some of the felsic tuff. On a lakeshore exposure 60 m east of the ripple-marked block, a very fine grained bed of tuff was observed to contain weathered-out, concretion-like forms that vary from 2.0 mm to 1.5 cm in diameter. On a fresh surface, the concretions were barely discernible from the matrix.

Associated with the cherty tuff beds are felsic breccias which have incorporated fragments from broken cherty lenses. One such cherty breccia stratigraphically underlies the more massive chert zone found in the walls of the adit near the south end of the northern arm of Wendigo Lake. There, the wall rock is composed of a massive unit of cherty tuff that contains lenses of massive and disseminated pyrite. The original cherty beds appear to have been broken and disrupted while the unit was still partially plastic.

Photo 2 - Ripple marks on the top of a tuffaceous bed within the felsic metavolcanic unit.

INTERMEDIATE TO FELSIC INTRUSIVE ROCKS

Quartz-rich feldspar porphyry dikes constitute the only intermediate to felsic intrusive rocks observed by the authors. These intrusive dikes are considered by the authors to be contemporaneous with the volcanism which gave rise to the thick volcanic sequence in the map-area. Three such dikes were located. Several outcrops of porphyritic rock located on the west shore of the northern arm of Wendigo Lake are similar in appearance to the

feldspar porphyry dikes, but are identified by the authors as crystal tuff and breccia. One 15 m wide dike outcrops on the west shore of the northern arm of Wendigo Lake about 450 m north of the adit mentioned previously. The dike ranges in colour from light salmon-pink in the highly porphyritic central zone to dark grey in the sparsely porphyritic chilled contact zone. A thin section was made of a sample from a similar dike 600 m southwest of the falls between Skead Lake and the northern arm of Wendigo Lake. Sericitized and saussuritized euhedral feldspar phenocrysts up to 3 mm in length, some grains of which exhibit indistinct zoning, are enclosed in a matrix of small euhedral to subhedral hornblende phenocrysts, partially altered feldspar grains (An_{38}), epidote, and small, less than 0.5 mm quartz grains. Quartz constitutes about 25 percent of the matrix. The flow direction is indicated by the parallel alignment of feldspar phenocrysts and hornblende grains.

MAFIC TO ULTRAMAFIC INTRUSIVE ROCKS

Mafic to ultramafic rocks intrude tuff and cherty tuff units parallel to their bedding to form concordant or subconcordant sills. Rocks of two major intrusive mafic sills of high magnesium tholeiitic composition and several smaller serpentinized mafic to ultramafic sills of basaltic to ultramafic komatiitic composition outcrop west of the northern arm of Wendigo Lake. The contact zone of the gabbroic rocks with the intruded tuff is aphanitic where observed by the authors. The fine-grained chilled contact margin grades within 12 m into the coarse-grained phase of the intrusive. The larger mafic sills are up to 350 m thick in places. Approximately 300 m northwest of the outcrops of Late Precambrian diabase on the west shore of the northern arm of Wendigo Lake, a 7.5 m wide, dike-like offshoot of a coarse-grained intrusive cuts almost perpendicularly through north-trending cherty tuffs.

The colouration of the weathered surfaces of the less altered mafic intrusive rocks is dark green. Mafic to ultramafic serpentinized rocks weather to a rusty brown. Fresh surfaces of the less altered and the serpentinized rocks are dark grey-green. Grains range up to 12 mm in size in the coarse phases of the intrusive.

In thin section, augite grains of the mafic intrusive rocks are generally well preserved, although partial alteration of many grains to uralite has occurred. Feldspar grains are completely altered to a sericite-saussurite assemblage. Serpentinization of the more ultramafic rocks is evident in thin section. No primary minerals or textures are preserved; the rock is totally altered to serpentine, sericite, biotite, uralite, and magnetite. The original rock may have been komatiitic peridotite.

MIDDLE PRECAMBRIAN

HURONIAN SUPERGROUP

Cobalt Group

GOWGANDA FORMATION

The rocks of the Cobalt Group, Gowganda Formation (Thomson 1957, 1966, 1968b; Robertson *et al.* 1969) are dated at 2288 ± 87 m.y. (Fairbairn *et al.* 1968, 1969) and consist of Coleman Member mudstone, arkose, greywacke, conglomerate and laminated argillite. The Early Precambrian basement, on which the Cobalt sedimentary rocks rest unconformably, has been described as mountainous (Schenk 1965; McIlwaine 1975) with up to 900 m relief in some areas (Card *et al.* 1973). In Bayly Township, the Precambrian metavolcanics form a 75 m high peneplain to the northwest of Wendigo Lake on which Gowganda Formation rocks fill depressions and dip steeply away from its flanks. Hewitt (1949) estimated a thickness of 150 m for the Cobalt Group rocks in Skead Township, whereas the authors have determined that the section in the southeast part of Bayly Township may exceed 350 m.

Many authors consider the Gowganda Formation to be of glacial origin (Grant 1964; Schenk 1965; Jackson 1965; Thomson 1966; Lindsey 1969; Young 1969; Lindsay 1970; Meyn 1973; Wood 1973); the conglomeratic units (Coleman Member; Robertson *et al.* 1969) are considered to be tillites (Schenk 1965; Thompson 1968a; Lindsey 1969; Wood 1973; Meyn 1973) or a series of glacial successions (Young 1969; 1973) and the laminated argillite unit (Firstbrook Member; Robertson *et al.* 1969; or La Cloche Formation; Wood 1973) glacial varves (Thomson 1957; Jackson 1965; Schenk 1965; Thomson 1966; Lindsey 1969; Wood 1973). Alternate theories which explain the observed features of the Gowganda Formation rocks have been postulated. K. D. Card (1969) suggested that the Cobalt sedimentary rocks may have been deposited by southward-flowing currents in a rift valley setting. Additional evidence gathered by Card *et al.* (1973) indicated that several other possible actions such as turbidity currents, mass slumping, fault scarp erosion (also proposed by McIlwaine 1975) or valley glaciation formed the Gowganda Formation. In Bayly Township, laminated (varved) argillite resembling those of the Firstbrook Member and containing numerous ice-rafted boulders and pebbles were mapped in several places by the authors and it is believed that these rocks represent deposition of material in a glacial environment. The conglomerates are poorly bedded, massive, and contain a variety of matrix (arkosic, argillaceous) and pebble types indicative of rapid erosion and deposition of material probably as a tillite or possibly as an alluvial fan or slumping of material from basement highs.

No continuous section of Cobalt Group rocks is exposed in Bayly Township. The lowermost unit, exposed northwest of Wendigo Lake, unconformably overlies the Precambrian basement rocks, and the uppermost unit outcrops to the east and south in the high escarpments. The middle of the section is not exposed in the map-area. Gowganda Formation conglomerate which fills depressions on the basement peneplain, is overlain by bluish grey bedded, pebbly mudstone. The next unit of the section that is exposed, a reddish-coloured laminated argillite containing dropstones, outcrops at the base of the escarpment east and south of Wendigo Lake and is not found on the basement peneplain in contact with mudstone. Overlying the laminated argillite are arkosic lenses, conglomerate, greywacke and mudstone. An idealized succession is shown diagrammatically in Figure 4; Figure 5, illustrates various measured sections.

In Bayly Township, the reddish-coloured laminated argillite unit lithologically resembles that of the Firstbrook Member as described by R. Thomson (1957), J. A. Grant (1964), Thomson (1968 a, b), B. E. MacKean (1968), D. D. Lindsey (1969) and S. M. Roscoe (1973) and the basal conglomerate, pebbly mudstone, greywacke, paraconglomerate and arkose resemble those of the Coleman Member (Thomson 1957; Schenk 1965; MacKean 1968; Lindsey 1969; Young 1969; Wood 1973; Meyn 1973; Card *et al.* 1973; McIlwaine 1975; and Lovell Because the laminated argillite horizon occurs totally within the sequence of Coleman Member rocks, it is considered by the authors to be a component of the Coleman Member.

Coleman Member

Rocks belonging to the Coleman Member of the Gowganda Formation outcrop extensively on the escarpments south and east of Wendigo Lake and unconformably overlie the Precambrian basement in several areas west of the northern arm of Wendigo Lake. The maximum exposed thickness in Bayly Township is estimated at about 350 m, approximately 75 m of which is exposed in the measured section on Skeletonpup Lake. Rocks of the Coleman Member consist of basal conglomerate, pebbly, and bedded mudstone, greywacke, paraconglomerate, massive and pebbly arkose, and laminated argillite.

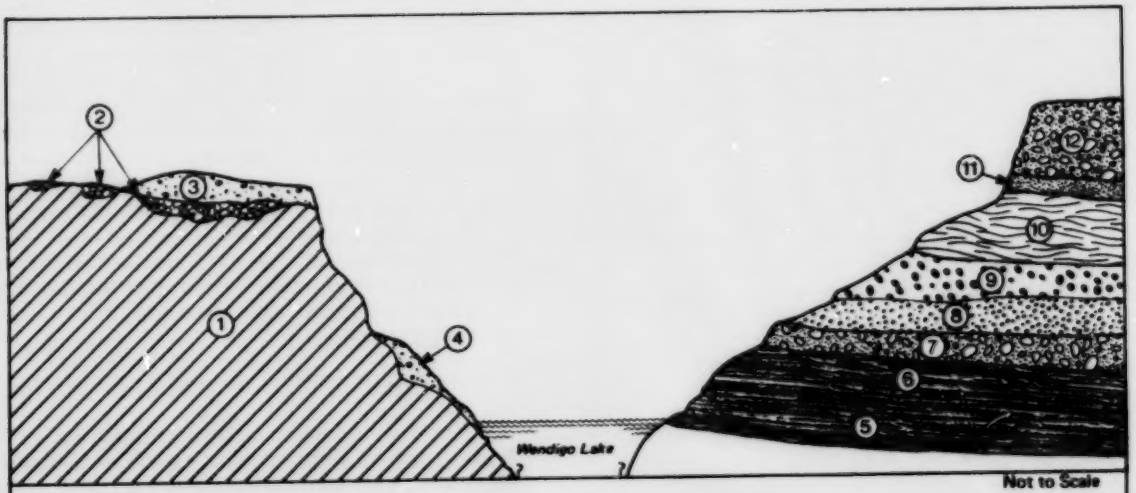
The Coleman Member basal conglomerate outcrops on topographically high Early Precambrian basement bedrock areas where it fills pre-Huronian depressions. It also outcrops in gentle slopes on the flanks of these basement highs.

Bluish grey, bedded, pebbly mudstone is "plastered" onto the steeper slopes of the basement highs (Photo 3) and overlies the basal conglomerate on the Precambrian peneplain. The "plastering" effect is especially evident on the west shore of the northern arm of Wendigo Lake. Here, dips vary from 20° to 70°, and strikes of the mudstone units are controlled by the proximity to and the configuration of the Archean basement rocks. In some instances, mudstone fills voids where jointed blocks had fallen away in the basement rocks. The unconformity between these sedimentary rocks and the basement rocks is exposed in numerous places on the west shore of the northern arm of Wendigo Lake.

Intermittent outcrops of basal conglomerate and pebbly mudstone occur in the river valley about 1.5 km west, and parallel to, the north-trending arm of Wendigo Lake. These units continue through north-central Bayly Township to join the section described by Hewitt (1949) for Skead Township.

The basal conglomerate and pebbly mudstone contain an assortment of different boulder, cobble, and pebble types that are as large as 2 m in diameter. The larger more conspicuous boulders are mainly granitic in composition, although boulders and pebbles of syenite, diorite, basalt, chert, jasper, iron formation, rhyolite, andesite, and feldspar porphyry were also noted. Pebbles are generally well-rounded and often attain a high degree of sphericity. The conglomerate matrix consists mainly of mudstone and grewacke, much of which is bedded and contains narrow gritty lenses. In the field, outcrops containing generally greater than 10 percent of visible pebbles were classified as conglomerate (after Pettijohn 1957); those with less than 10 percent pebbles were classed as paraconglomerate or pebbly mudstone, pebbly arkose, and so on.

The top of the pebbly mudstone section and its contact with the intertongued unit of laminated argillite is not exposed either on the top or on the flanks of the Precambrian peneplain, or at the base of the exposed section of Cobalt Group rocks east or south of Wendigo Lake. The upper contact between the argillite unit and the overlying greywacke unit rocks is sharp in some areas and interbedded in others. In the measured section south of Wendigo Lake, a thick bed of massive, gritty, mudstone paraconformably overlies the argillite (Photo 4). To the north of the lake, the argillite is overlain disconformably by intact framework conglomerate in one area and pebbly arkose in another. In southeast Skead Township, Hewitt (1969) described the interbedding of laminated argillite and quartzite.



LEGEND

1	Precambrian basement
2	Basal conglomerate filling Precambrian basement depressions
3	Bedded, pebbly, blue-grey mudstones (uppermost unit exposed on basement peneplain)
4	Bedded, pebbly, blue-grey mudstones "plastered" onto basement paleoslopes
5	Laminated red argillite with dropstones (lowermost unit exposed east and south of basement highs)
6	Laminated pale blue - grey argillite with dropstones (contact with red argillite is graditional or two argillites are interbedded)
7	Pebbly arkose
8	Greywacke
9	Paraconglomerate
10	Pebbly arkose and mudstone
11	Arkose
12	Arkosic paraconglomerate

Note: Section is idealized - units 7 to 11 (incl.) are not necessarily in order or present in all sections.

Figure 4 - Idealized section showing stratigraphic relationships of Cobalt Group sedimentary rocks in Bayly Township.

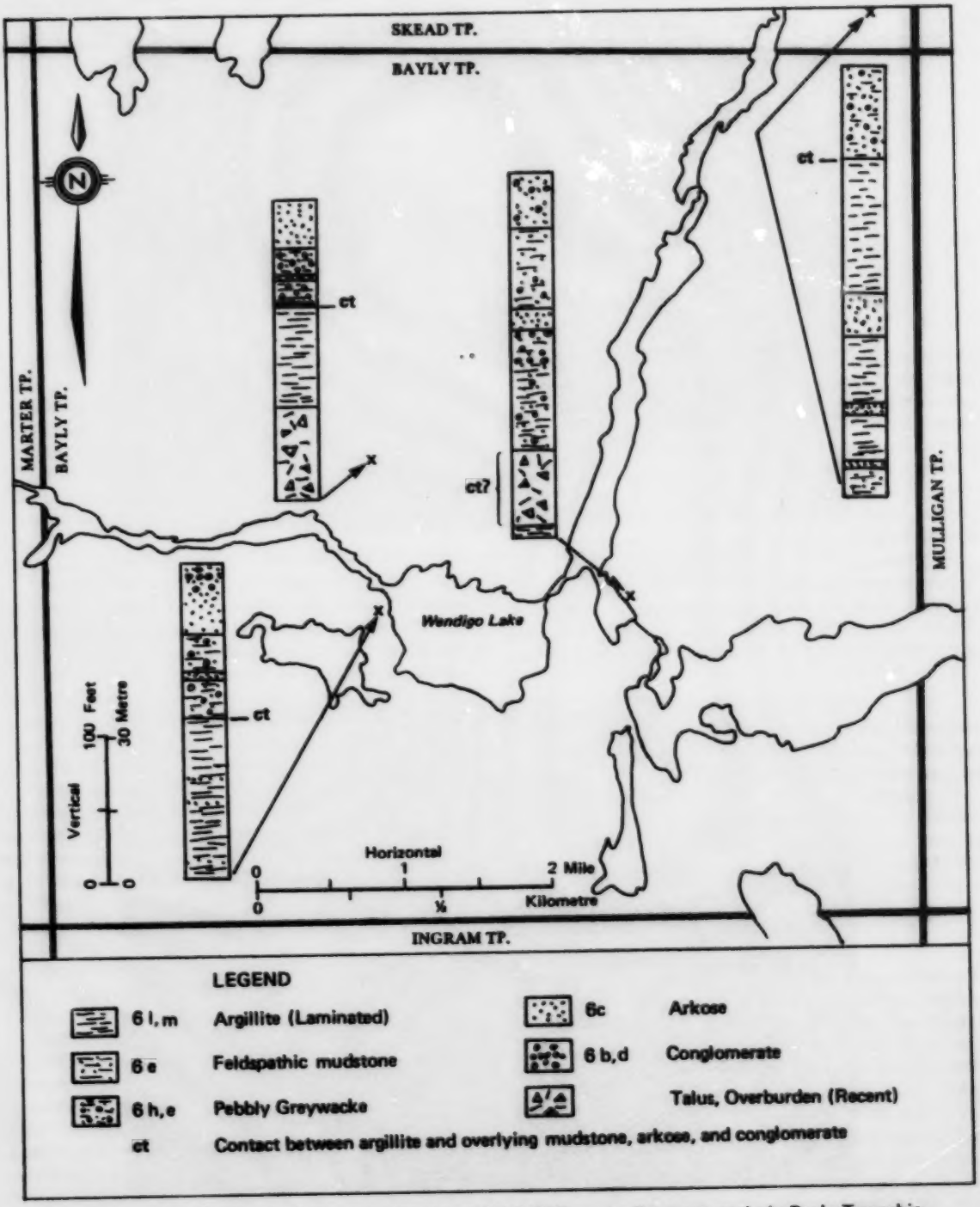


Figure 5 - Sketch map showing measured sections of Cobalt Group sedimentary rocks in Bayly Township.

Photo 3 - Steeply bedded pebbly argillite "plastered into crevices in the underlying Archean coarse - grained diorite

Photo 4 - The contact between Coleman Member laminated argillite and overlying feldspathic greywacke.

TABLE 4 | MODAL ANALYSES OF METASEDIMENTS, BAYLY TOWNSHIP.

	F1	F9	F36	F37	F61
Quartz	32.9	33.3	35.9	43.3	32.8
Plagioclase	5.3	4.5	4.0	8.3	6.4
Potassic Felspar	25.3	47.6	34.5	35.4	49.0
Rock Fragments	23.9	10.1	10.3	7.9	7.4
Matrix	12.6	4.5	15.4	5.1	4.4

F1 - High-rank greywacke (subgreywacke) along road, west-central boundary of Bayly Township.
F9 - Pink arkose; northwest shore of main body, Wendigo Lake.
F36 - High rank greywacke (feldspathic greywacke) middle of section, west shore of main body, Wendigo Lake.
F37 - Arkose; top of section west shore of main body, Wendigo Lake.
F61 - Arkose; 0.8 km northwest of main body, Wendigo Lake.

The laminated argillite horizon outcrops along the south shore of the west-trending arm of Wendigo Lake and several places on the east shore of the northern arm of Wendigo Lake. In Bayly Township, its maximum thickness is estimated at 90 m. The basal contact of the argillite unit is not exposed in the escarpments formed by rocks of the Coleman Member bordering the Precambrian basement peneplain or on the peneplain in contact with mudstone.

Typically, the argillite is composed of graded, well-laminated, reddish-brown varved claystone. Regular laminations (varve couplets) distinguish it from the more variably-bedded, Coleman mudstone. Varve couplets can be about 1 cm thick and consist of reddish-brown basal parts and thinner greyish red upper parts. Within some sections, the colour of the argillite changes imperceptibly from reddish brown to blue-grey stratigraphically upwards in the section while the varved nature of the rock is maintained. In other areas, distinct reddish brown couplets and bluish grey couplets are interbedded with each other. Thin, less than 2 mm wide, lenses of chlorite-rich sand form the base of many laminae. Also included along bedding planes are ice-rafted pebbles, a few of which attain diameters of 10 cm.

Examination of thin sections reveals that grading is evident and appears varve-like. The basal part of each varve contains minute angular feldspar and quartz chips and platey flakes of chlorite and muscovite aligned along the bedding planes. These grain types constitute about 10 percent of the coarser base of the varve and less than 2 percent of the top. The matrix consists of light brown-coloured (hematite stained?) clay-size grains and very fine grained opaque minerals. The majority of the dropstones, of both pebbly and sand sizes, are granitic. A thin section containing a large dropstone and several small dropstones shows them to be compositionally and texturally similar granitic rocks.

Rocks of the Coleman Member overlying the argillite comprise feldspathic greywacke, mudstone, paraconglomerate, and arkose. Most of the high rank greywacke, (Table 4, Figure 6: subgreywacke and feldspathic greywacke; Pettijohn 1957), is dark grey to grey-blue on fresh and weathered surfaces. Grains vary from clay to pebble sizes and exhibit a variety of compositions in thin sections as follows: strained and unstrained quartz, potassic feldspar (microcline and "orthoclase"), plagioclase, siltstone, chert, quartzite, tuff, basalt, diorite, granite, rhyolite, and gneiss. This variety of pebble types is seen macroscopically in the paraconglomeratic horizons. Chlorite, clay, and silt-sized clastic grains make up the matrix, which itself constitutes about 15 percent of the rock.

At the southern end of the Huronian sediment-filled valley about 350 m north of the junction of the late Precambrian diabase dike and the west-trending arm of Wendigo Lake, Coleman Member orthoconglomerate disconformably overlies the laminated argillite unit. The intact framework conglomerate contains fluvial features such as scour channels and crossbedding which the authors believe may represent river channel scours within the laminated argillite horizon.

The arkose of the Coleman Member commonly weathers to a buff, buff-green or buff-pink and is medium buff-grey or green-grey on the fresh surface. Quartz and feldspar, which together make up more than 85 percent of the arkose (see Table 4) are the dominant constituents. Detrital grains are rounded to subrounded and exhibit moderate sphericity. They are cemented by quartz and feldspar grains. The matrix which is fine grained and chloritic, generally forms less than 5 percent of the rock. In outcrop, rare traces of bedding were observed in the arkosic units, but no strikes or dips could be determined.

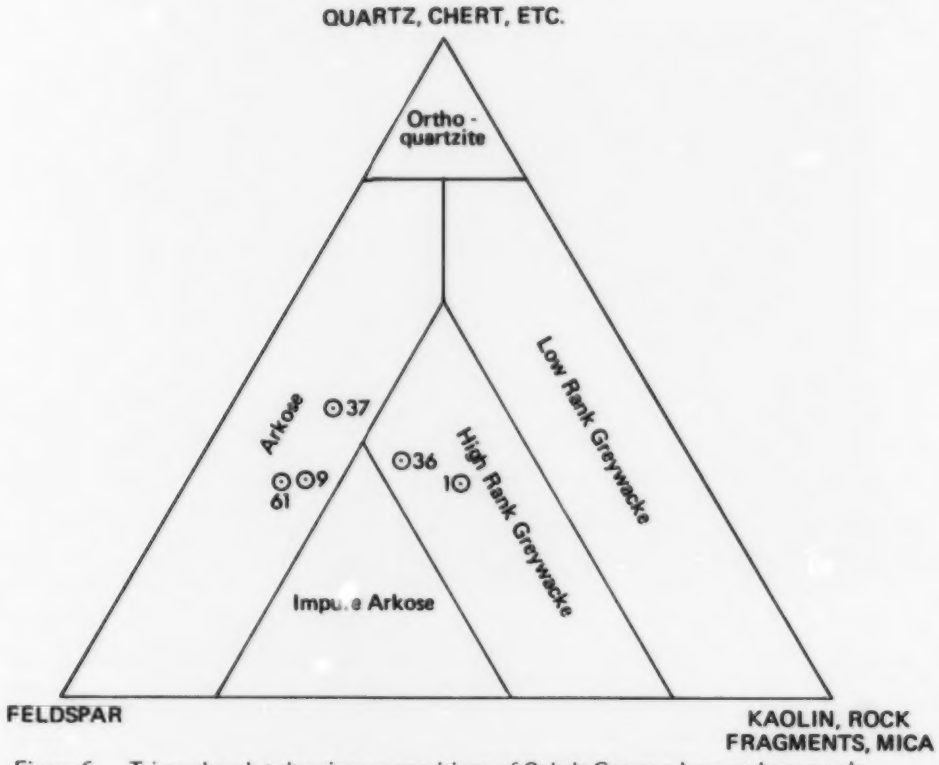


Figure 6 - Triangular plot showing compositions of Cobalt Group arkose and greywacke.

MAFIC INTRUSIVE ROCKS (NIPISSING DIABASE)

Nipissing Diabase, which underlies about 15 percent of the map-area, outcrops in three distinct areas in Bayly Township. The Nipissing Diabase intrusions are located as follows, from largest to smallest: a shallowly-dipping sill-like body in the southwest corner of the township (southwest Bayly sill); a long, narrow, sill-like intrusion extending from the southeast corner to approximately the centre of the township (Skeleton Lake sill); and a narrow dike striking northwest from the northern end of Mallard Lake to the southeastern part of Skeleton Lake (Mallard Lake dike). Age determinations of Nipissing Diabase in other areas have yielded dates of 2155 ± 80 M.Y. and 2180 ± 40 M.Y. (Van Schmus 1965), 2162 ± 27 M.Y. (Fairbairn *et. al.* 1968) and 2140 M.Y. (Symons 1970).

The "southwest Bayly sill" displays the features described by J. L. Jambor (1971a) as typical for the base and middle sections of Nipissing Diabase sills. The width of the aphanitic, basal, blackish-green, chill zone is about 5 cm. This chilled margin grades over a distance of about 0.5 to 1.0 m into fine-grained, greenish coloured diabase; and, over an additional 1 to 2 m into the medium-grained, dark greenish-grey hypersthene diabase phase of the intrusion. The sill dips at a shallow (5 degrees to 10 degrees) angle to the southwest and attains a maximum thickness in the map-area of about 100 m.

The mineralogy and textures of the various phases of Nipissing Diabase observed in thin sections from Bayly Township correspond with those identified by Jambor (1971a) and M. E. Hriskevich (1952, 1968). The chilled quartz diabase at the base of the sill is in part glomeroporphyritic and is composed predominantly of feldspar, epidote, chlorite, and quartz with minor amounts of other accessory minerals. Feldspar forms acicular and short grains arranged in a radiating feather-like and occasionally a glomeroporphyritic habit. These plagioclase grains are fresh-looking, but contain numerous inclusions. Detailed examination revealed the grains to be altered completely to albite, epidote, and chlorite.

Original pyroxene is totally altered to chlorite and is interstitial to the albite pseudomorphs. Quartz is found as

minute isolated patches (1 percent) between other grains. Present also in minor quantities are small, brownish-coloured, high-relief grains of a semi-opaque mineral, possibly altered olivine. Alteration within the contact zone may be deuteric.

The grain size increases stratigraphically upwards in the sill until feldspar and pyroxene are readily distinguished in hand specimen. Pyroxene forms clots or large grains up to 8 to 10 mm in diameter which when weathered leave rusty-coloured pits. Microscopically, plagioclase (labradorite, An_{54}) grains are generally well-preserved; however, in some sections, the grains are almost totally altered to sericite, epidote, and albite. Ophitic-textured pyroxene grains up to 10 mm in maximum dimension appear fresh and include the plagioclase laths. Hypersthene forms the dominant pyroxene mineral, but minor amounts of augite are present. There is a slight alteration of pyroxene to uralite, chlorite, and very minor biotite. Quartz and magnetite form minor interstitial constituents. In one thin section, olivine grains with magnetite-filled fractures are present. The granophyric, varied textured, and upper quartz diabase phases, which typically occur in diabase sills (Jambor 1971a), are not present in the "southwest Bayly sill".

The "Skeleton Lake sill" exhibits textures and mineralogical compositions similar to those of the "southwest Bayly sill". The quartz diabase chilled phase is fine grained, as has already been described, but not as highly altered. Short, radiating, plagioclase crystalites are fresh-looking; branching, feather-like pyroxene (hypersthene) grains are only slightly altered. Minor quartz and magnetite are present.

The plagioclase of the hypersthene diabase phase of the "Skeleton Lake sill" is altered to sericite and pseudomorphic albite; the hypersthene is partly altered to chlorite and uralite. Thin section examination shows that the medium-grained hypersthene diabase phase contains up to 3 to 4 percent interstitial and graphic quartz.

The "Mallard Lake dike" probably is connected to a larger diabasic sill located in Ingram and Pense Townships to the south. The dike rock is similar in appearance and composition to the medium-grained, hypersthene phase of the Nipissing Diabase. Unaltered euhedral plagioclase, which makes up about 60 percent of the rock, is enclosed by pyroxene (hypersthene and minor augite) to form ophitic texture. Parts of the pyroxene are altered to uralite. Magnetite is present in quantities up to 1 percent. A mineral of high relief commonly found in close proximity to the magnetite in thin section, appears brownish yellow in plain light and may represent iddingsite or bowlingite after olivine; it comprises about 1 percent of the slide. Quartz is present in trace amounts.

METAMORPHISM OF COBALT GROUP ROCKS

The grade of regional metamorphism of the Gowganda Formation rocks in Bayly Township is similar to that described by H. D. Meyn (1973), and H. L. Lovell and E. D. Frey (1976), that is, low greenschist or prehnite-pumpellyite facies. Locally, outcrops of Coleman Member sedimentary rocks, near and in contact with sills of Nipissing Diabase exhibit chlorite "spotting" as described by Jambor (1971b) for the Cobalt area and MacKean (1968) for the Elk Lake area. Chlorite spots the argillite observed in rocks of Bayly Township ranged in size from 1 to 4 mm. It was also noted that the reddish brown colouration of the argillite is not present in the rock within several tens of metres of the intrusive diabase contact. R. Thomson (1966) noted this same phenomenon in the reddish-coloured Firstbrook argillite intersected in a long diamond drill hole in Henwood Township. In Bayly Township and other areas such as Barr and Firstbrook Townships where this relationship was also noted by the authors, the reddish colour is "bleached" to a dark blue-grey. Primary sedimentary structures and features are preserved. Thin sections of laminated argillite from areas close to the diabase contact in Bayly Township show that the fine-grained matrix has been recrystallized, chlorite has been remobilized, and feldspar grains have been partly altered to sericite. This apparent "bleaching" by the diabase appears to bear no relationship to the primary interbedding of the two differently-coloured units of the Firstbrook Member argillite as previously described, rather it is a contact metamorphic effect, possibly resulting from the conversion of hematite to chlorite and pink feldspar to sericite.

LATE PRECAMBRIAN

MAFIC INTRUSIVE ROCKS

A northeast-trending diabase dike of Late Precambrian age may constitute part of the Abitibi swarm of diabase dikes. Abitiți dikes have been dated at 1230 M.Y. (Fahrig and Wanless 1963) and more recently at 2147 ± 68 M.Y. (Gates and Hurley 1973). Three main textural phases of the northeast-trending dike were observed in Bayly Township as follows: massive augite diabase; granophyric-textured diabase; and varied-textured diabase. These textures are similar to those described for the upper parts of Nipissing Diabase sills by Hriskevich (1952, 1968) and J. L. Jambor (1971a) and may indicate that the dike constitutes later differentiates of the Nipissing Diabase sill which have filled a linear fracture zone. T. M. Gates and P. M. Hurley (1973) suggest that Abitibi dike swarms and Nipissing Diabase sills may be related since they appear chemically and petrographically similar and have similar

Photo 5 - Variably textured Precambrian diabase.

ages. However, the dike in Bayly Township was observed to cut all other rock types including Nipissing Diabase. This cross-cutting relationship may be seen on the south edge of a rehabilitated gravel pit along the west boundary of Bayly Township, where an outcrop contains diabase fragments in a diabasic matrix. This is interpreted, in this report, to be the inclusion of Nipissing Diabase fragments in the margins of the intruding Late Precambrian diabase dike.

All three phases of diabase are observable in outcrops on the shores of the northern arm of Wendigo Lake; the augite and varied-textured diabase is visible on the west shore and the granophyric diabase on the east shore. The granophyric phase is also well displayed in an outcrop on the south shore of the west-trending arm of Wendigo Lake. Fresh surfaces of the augite diabase phase of the dike are similar in appearance to those of Nipissing Diabase. Augite, the dominant pyroxene in all phases of the dike, is interstitial to euhedral plagioclase laths. The plagioclase laths vary in composition from andesine to labrodorite (An_{52} to An_{72}), are as much as 2 mm in length and occasionally form glomeroporphyritic clusters.

Weathered surfaces of outcrops of granophyric-textured diabase have a typical pinkish colouration. In thin section, twinned stubby laths of plagioclase, which constitute about 25 percent of the section, are frequently rimmed by an orthoclase-quartz assemblage. Orthoclase and microcline also form large anhedral to subhedral grains containing graphic intergrowths of quartz, some of which have a euhedral shape. Quartz intergrowths within individual grains are roughly aligned and come to extinction at the same position. Minor calcite, chlorite, and semi-opaque, brownish-coloured minerals are interstitial.

The varied-textured phase of the dike (Photo 5) is identical to that described by Jambor (1971a) for Nipissing Diabase. Extremely coarse-grained phases (grain sizes up to 4 cm) grade into, and in places appear to intrude more homogeneous, medium-grained phases. These coarser grained phases are often pegmatitic in appearance.

PHANEROZOIC

CENOZOIC

PLEISTOCENE AND RECENT

Lodgement and ablation till; esker sand, gravel and boulders; and glacial lake bottom silt and cl· were deposited during or shortly following the reces.on of the Winconsinan glacier. The mean of several measurements of glacial striae indicates movement of the glacier from the north at about 175°. About 10 800 BC, glacial Lake Barlow Ojibway formed to the south of the retreating ice mass (Boissonneau 1968). During the time of deposition of the varved clays of the Little Clay Belt from this post-glacial lake, the outcrop areas in Bayly Township

were above or at wave base and therefore were wave-washed. Areas between the high standing "islands" of diabase and sedimentary rocks became the site for the deposition of reworked glacial material, and to the south and east, varved glacial clays.

Bedrock in the western part of Bayly Township is overlain in part by esker delta sands and gravels originating in part by esker delta sands and gravels originating from the large Munro esker that extends into Bayly Township from the north. A smaller esker parallels the north-trending arm of Wendigo Lake on the east shore and continues intermittently south to Ingram Township in the south. In places, particularly along the east shore of the north-trending arm of Wendigo Lake and in the vicinity of the juncture of Skeleton and Wendigo Lakes, the esker sands have been winnowed out and a lag concentrate of boulders and gravel predominates.

Recent deposits comprise swamp peat, lake bottom silt and clay, and glacial sand and gravel reworked by modern streams and lakes.

STRUCTURAL GEOLOGY

FAULTS

Three major linear trends are evident in Bayly Township. These include: a prominent set of northeast-striking linear features and faults trending parallel to the strike of the Archean strata; several northwest-striking faults; and, a number of east-northeast striking faults and lineaments. Joint and foliation measurements reflect all three major trends.

The most prominent set of linear features and faults is displayed by the parallel drainage pattern in the Archean volcanic rocks west of the north-trending arm of Wendigo Lake. Streams flow in depressions in softer strata between more erosion-resistant, north-northeast striking ridges of dacitic breccia and tuff. Shear and foliation directions indicate probable en-enchelon, strike, slip faulting along the depressions between ridges.

Much of the faulting of the volcanic rocks in the map-area is pre-Huronian. Evidence indicates that the topography of the Archean rocks before deposition of the Huronian sedimentary rocks was steep and clifflike, and that the Coleman Member argillite was "plastered" onto these slopes and also into undercuts. Therefore, steep paleoslopes, shearing parallel to the edge of the Archean topographic high, and the linearity of the contact denote a probable fault origin for the scarps. The Cobalt sediment-filled valley 1.5 km west of the northern arm of Wendigo Lake also is a possible pre-Huronian fault zone. Offset of the Late Precambrian diabase dike by a north-northeast-trending fault suggests later movement occurred along pre-existing fault zones.

Several northwest-trending faults cause minor offsets in the Early Precambrian and Huronian rocks. These faults appear to represent en-echelon offshoots or continuations of the major Lake Timiskaming Rift Valley system of faults described by P. S. Kumarapeli and J. A. Saull (1966) and H. L. Lovell and T. W. Caine (1970). The northwest-trending fault that cuts across the southwestern one-third of the township has vertically downdropped the Huronian sedimentary rocks on the north side a distance of about 20 m. The "Mallard Lake" Nipissing Diabase dike may infill a similar northwest-trending lineament or fault zone.

East-northeast-trending faults and lineaments roughly parallel the strike of the Keweenawan diabase dike. These faults are left lateral and can displace Archean metavolcanic units up to 100 m. On opposite sides of the dike itself, the metavolcanics appear to be offset several hundreds of metres.

FOLDS

No major tectonic fold axes are evident in the map-area. However, the volcanic rocks form part of the southeastern limb of a large anticline, the axis of which plunges east through the central part of Skead Township. The "Skead Volcano" has been tectonically tilted on its side to form the observed anticlinal structure (Ridler 1969).

The variations in dips in the Cobalt Group rocks are controlled predominantly by the Archean volcanic bedrock topography and differential rates of compaction of the sedimentary rocks rather than by tectonism.

ECONOMIC GEOLOGY

Following the initial silver discoveries at Cobalt in 1903, prospectors moved northwards along the Larder and Blanche River Systems in search of silver in outcrops of Nipissing Diabase and Cobalt Group sedimentary rocks (Burrows and Hopkins 1922). As a result, gold was discovered at Larder Lake, and during the gold rush in 1906-7, prospectors migrated southwards, exploring for gold (Hewitt 1949) in the Early Precambrian (Archean) metavolcanics and metasediments. No economic silver or gold mineralization was discovered in Bayly Township, but minor amounts of silver were found. Several small gold producers were in operation in Catharine and Skead Townships during the late 1920s and early 1930s (Grant 1964, Hewitt 1949). More recently, exploration efforts have been channelled into the search for base metals in the felsic sections of the volcanic pile in Bayly Township.

GOLD

Although little information dealing with the exploration for gold is on file in the Kirkland Lake Resident Geologist's office, examination of several old overgrown trenches and test pits during the current mapping revealed that most work was done in minor shear zones that contained quartz-calcite veins. The vein material and the wall rock, mainly felsic to intermediate pyroclastic rocks, are very sparsely mineralized with pyrite and chalcopyrite. Grab samples of vein and wall rock material taken by the authors from two different pits for which no information of previous work is available yielded best assays of 0.005 ounce of gold per ton and less than 0.02 ounce of silver per ton (assays by Swastika Laboratories Limited).

SILVER-COBALT

Silver values were reported in several localities in townships adjacent to Bayly Township (Burrows and Hopkins 1922). The silver is associated with quartz-calcite veins and aplitic dikes in diabase that contain varying amounts of smaltite, niccolite, erythrite, and other related minerals. Several pits were found in the Nipissing Diabase around Wendigo Lake, but only minor pyrite and chalcopyrite mineralization was evident in the quartz-carbonate veins and aplitic dikes that were blasted. High cobalt values in the Nipissing Diabase south of Skeleton Lake in Bayly and Mulligan Townships were reported in notes by R. Thomson (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake).

BASE METALS

To date, no base-metal mineralization of economic interest has been discovered in Bayly Township. In one locality on the northern arm of Wendigo Lake, a large open-cut (adit) in a host rock of cherty (rhyolitic) tuff and breccia has exposed a zone of massive and disseminated pyrite. Grab samples of these rocks were collected for assay during the current mapping. They yielded 0.01 percent Cu, 0.01 percent Zn, 0.03 percent Pb, and 0.37 ounce of silver per ton (assays by Swastika Laboratories Limited). This cherty unit, which contains pyritic lenses and disseminated pyrite where exposed, can be traced intermittently over a distance of 3 600 m long the west shore of the northern arm of Wendigo Lake. Hewitt (1949) in his report on adjacent Skead Township also mentioned the occurrence of pyrite and pyrrhotite in rhyolite and cherty tuffs.

DESCRIPTION OF PROPERTIES

The following information applies to properties marked with an asterisk (*):

Assessment work was not required to be filed with the Ontario Division (Department) of Mines until 1947. Therefore, for these properties, there is no record of any work in the Resident Geologist's Files, Ontario Ministry of Natural Resources Kirkland Lake for the properties marked with an asterisk. The property description is based on the examination of pits and trenches located during the mapping, and the matching of the locations of these workings with claim record sheets available on microfiche in the Mining Recorder's office at Kirkland Lake. The assumption was then made that the former holder or patentee of the claim(s), was responsible for the majority of the work observed at the various locations. The property was then described by the name or names of the holder(s); the number in parentheses corresponds to the property number on the map (back pocket).

BUTE LARDER OCCURRENCE (1)[1]

Eight unpatented mining claims were formerly held by the Bute Larder Gold Mining Sydicate Limited in the central part of Bayly Township north of Wendigo Lake. The western half of the claim group is underlain by fine-grained argillite, arkose, and diabase; the eastern part by intermediate breccia and tuff, and mafic intrusive rocks. Work on the group was confined to pitting and trenching a narrow fracture zone in the breccia continuously for a distance of about 250 m. This zone strikes N 15° W and dips 80° west to vertical. G. L. Holbrooke, in a report on the property in 1938 stated "At various places along this length, the fracture has been filled by short irregular quartz lenses from 2 to 18 inches [5 to 45.7 cm] wide. The quartz lenses and about 2 inches [5 cm] of the immediate wallrocks show a weak to medium mineralization of pyrite and chalcopyrite. Both the quartz and mineralization are very erratic in distribution."

A chip sample taken by Holbrooke across 15 cm of mineralized vein yielded values of up to $2.80 per ton of gold (1938 price at $35.00 per ounce). Gold assays ranging up to about $17.00 per ton (1938 price at $35.00 per ounce) and copper values of 3 percent were reported in the Prospectus of the Bute Larder Syndicate (Resident

[1] Number in parentheses refers to property number shown on Map P. 1198, Rev. (back pocket).

Geologist's Files Ontario Ministry of Natural Resources, Kirkland Lake). Assays of a selected samples of the best-looking mineralized dump material taken by the writer yielded 0.05 ounce of gold per ton; 1.17 ounces of gold per ton; and 0.076, 0.04, and 0.13 ounce of silver per ton; 1.89 percent copper; and 0.01 percent lead (assays by Swastika Laboratories Limited).

BROOKS OCCURRENCE* (2)

In 1906, D. W. Brooks staked one claim, T.1813, in the southwestern part of Bayly Township. Two years later he staked an additional six claims, L.744, L.816, L.826, and L.950 to L.952 inclusive, around his original claim. These claims were later patented by Brooks, but the patents, except for the surface rights on four of the claims, have lapsed.

There is no recorded work on file for this property in Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake. However, a small shaft estimated to be about 10 m deep was located while mapping. The shaft was apparently sunk on a 10 cm wide zone of quartz-carbonate stringers, the strike of which could not be determined. The stringers are in a host rock composed of the hypersthene phase of Nipissing Diabase. Minor amounts of pyrite are disseminated throughout the vein material.

FLANAGAN OCCURRENCE* (3)

In 1938, P. J. Flanagan brought to patent four claims numbered L. 10946-10949 inclusive located north of the northern arm of Wendigo Lake. The patents have since expired. Although no work is recorded for these claims, a trench and small pit were found on these and other unpatented claims formerly held by Flanagan. The trench, which measures about 0.6 m deep, 0.6 m wide, and 15 m long, is located about 600 m north and 100 m west of the waterfalls separating Skead Lake and the northern arm of Wendigo Lake. It intersects a small outcrop of pebbly argillite close to the Huronian-basement contact, but no mineralization was evident. About 460 m west of the waterfall mentioned above a small pit was blasted in the edge of an outcrop of crystal tuff to expose a few narrow 1.3 cm wide seams of pyrite.

A quartz-carbonate vein on the west shore of the northern arm of Wendigo Lake, about 1 100 m south of the falls, was also included in Flanagan's former group. The 15 to 25 cm wide vein is within a shear zone 1 m wide in a massive andesite-basalt flow; it strikes N 75° W and dips 65° southwest. Sparse pyrite with malachite staining is found as isolated patches in the vein material. Assays of a grab sample of the mineralized vein taken by the writer yielded 0.005 ounce of gold and 0.02 ounce of silver per ton and 0.05 percent copper (assays by Swastika Laboratories Limited).

HUDSON BAY OCCURRENCE (4)

In 1971, Asarco Exploration Company of Canada Limited performed geological and geophysical surveys on a group of 29 unpatented mining claims (cancelled) optioned from The Hudson Bay Mines Limited. This claim group straddled the northern arm of Wendigo Lake.

Ground magnetometer and vertical loop electromagnetic surveys did not outline any anomalies or conductors of importance on the property. No economic mineralization was uncovered or indicated by the geological survey. However, pyrite was found to be widely distributed as lenses and disseminations in the felsic and intermediate breccia, tuff, and cherty tuff. One such reported sulphide showing located about 450 m north of the junction of the main body and the northern arm of Wendigo Lake was visited by the authors. The claim containing this showing was originally staked in 1920 by E. B. DeCamps. The majority of the work, however, was done by H. R. Lidyard between 1926 and 1930. An open cut (adit) into the cliff face has exposed a zone of massive and disseminated pyrite approximately 7 to 10 m in width, which is divided in two by a 3 m pillar of unconformably overlying Cobalt Group mudstone. A grab sample of the massive pyrite taken from the south face of the adit by the writer assayed 0.03 percent Pb, 0.01 percent Cu, 0.01 percent Zn, 0.01 ounce of Ag per ton, but no gold (assays by Swastika Laboratories Limited).

An old exploration shaft, estimated to be approximately 13 m deep was located on a peninsula on the west shore of the northern arm of Wendigo Lake near the centre of the Hudson Bay Group, about 300 m south of the Late Precambrian diabase dike. No work has been recorded for the shaft area, but original claim records indicate that most of the work was performed by D. Cameron in 1926. The shaft was apparently sunk on a 25 to 30 cm wide north-striking quartz-carbonate vein in a massive medium-grained mafic flow or mafic intrusive rock. Dump material contained ,minute isolated patches of cobalt bloom and sporadic crystals of pyrite.

H. R. LEDYARD [1939]* (5)

A claim covering a point of land on the north-central shore of the main body of Wendigo Lake was restaked by H. R. Ledyard in 1939. After commencing a small open cut into a diabase face, Ledyard transferred this claim, in 1940, to H. L. Bowes who continued the work. The open cut was blasted about 7.5 to 10 m feet into an outcrop of Nipissing Diabase (part of the "Skeleton Lake sill"). No evidence of a vein was seen in the face of the open cut, but material from the waste dump contained remnants of a quartz carbonate vein less than 3 cm wide, and lenses and disseminations of pyrite in the diabase host rock.

F. MARTIN AND T. C. TAYLOR [1939]* (6)

A. McQuarrie originally staked a group of claims in 1917 south of Skeleton Lake, straddling the boundary between Mulligan and Bayly Townships. These claims were restaked and worked intermittently after 1939 by F. Martin and T. C. Taylor. A 5 m long trench was blasted on a narrow quartz-carbonate vein in a 0.75 m wide shear zone in Nipissing Diabase ("Skeleton Lake sill"). The only observed mineralization consisted of small specks of pyrite and chalcopyrite in the quartz-carbonate vein material. Notes made by R. Thomson of conversations with various prospectors (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake) working south of Skeleton Lake indicated that cobalt mineralization and high grade gold values were obtained.

F. E. McMAHON AND W. ERRINGTON* (7)

Two claims, L. 16031 and L. 16032 on the north shore of the main body of Wendigo Lake were patented by J. McMahon in 1937. Recent claim maps show that the patents are still valid although survey lines were not found during the present mapping.

Burrows and Hopkins (1922) described an occurrence consisting of "three pits in diabase showing some small gash veins... . Some of the material on the dump of one pit carries a little galena, zinc blende, and garnet in calcite-quartz veinlets".

These pits were not located during the current mapping. However, two small pits in massive medium-grained unmineralized gabbro were found in the southern part of claim L.16031. The current owners of the claims are F. E. McMahon and W. Errington.

PEERLESS CANADIAN EXPLORATIONS LIMITED [1963] (8)

In 1963, A. S. Bayne and Company, Consulting Engineers, examined a group of 18 contiguous unpatented mining claims held by Peerless Canadian Explorations Limited. Only four claims of the group lie in Bayly Township, adjacent to the extreme southeast corner of the township. Most of the bedrock of the four claims is obscured by swamp, clay and gravel, but outcrops of Coleman Member conglomerate, argillite, and arkose found on the shore of Mallard Lake are believed to underlie the group. No mineralization has been discovered on the property. However, a quartz-carbonate fracture system in diabase on the adjoining property of Fox Lake Mines at the southern end of Mallard Lake yielded high assays of Pb, Ag, Au, Co, Cu, and Zn (Bayne 1963). These fractures and others located nearby were believed by the consulting engineer to extend onto the Peerless Canadian Property.

C. R. WOOLLINGS AND OTHERS (9)

Claim L. 19510 at the western end of the west-trending arm of Wendigo Lake, was patented by E. V. Woollings in 1930. No evidence of work done on the claim was found, and there is no mineral exploration information filed in the Resident Geologist's Files Ontario Ministry of Natural Resources, Kirkland Lake. The current owners of the claim are C. R. Woolings, T. E. Woollings, and K. W. Brian of Englehart.

SUGGESTIONS FOR FURTHER INVESTIGATION

It has been known since the mapping by Burrows and Hopkins (1922) that intermediate to felsic volcanic rocks exist in Skead and Bayly Townships. Hewitt (1949) described the "...rhyolite, trachyte, rhyolite tuff, black slate, cherty tuff, acid agglomerate, and pyroclastics" of Skead Township in some detail and noted that they were commonly mineralized with pyrite and pyrrhotite. As has been previously mentioned, cherty tuff with containing lenses and disseminations of pyrite were mapped during the current survey and found to extend intermittently for 3600 m along strike. The volcanic section from the edge of the Round Lake Batholith in eastern Chamberlain Township to the west-central part of Skead Township represents a differentiated volcanic pile. Cherty and rhyolitic zones in Skead and Bayly

Townships are the late differentiates which represent the stratigraphic top of a cycle. The massive lenses and disseminations of pyrite indicate that there are sulphide minerals associated with the felsic rocks. It is therefore suggested that in Bayly Township, further detailed investigations be made of the units of cherty tuff, breccia, and related sulphide mineralization on the west shore of the northern arm of Wendigo Lake. It is possible that additional felsic members stratigraphically higher than those on the west underlie the lake and the Cobalt sedimentary rocks on the east shore.

Parts of the area may warrant further academic investigation as well. Interest has already been expressed in the intermediate and felsic volcanic rocks for obtaining oriented core samples for paleomagnetic studies and samples for chemical analyses (R. H. Ridler 1975, personal communication).

The abundance of high vertical cliff exposures of the Cobalt Group sedimentary rocks lends itself readily to the measurement of sections to determine the interrelationship between the units of the different members of the group. This, and the exposure of the Early Precambrian (Archean)/Huronian unconformity on about a dozen different outcrops north and west of the eastern and northern arms of Wendigo Lake, respectively, would be a great aid in the interpretation of the paleoenvironment and paleogeography that existed before and during deposition of the Huronian rocks.

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